

U.S. DEPARTMENT of ENERGY

ALTERNATIVE FUEL NEWS

An Official Publication of the Clean Cities Network and the Alternative Fuels Data Center

From the Office of Energy Efficiency and Renewable Energy

AFVs in India

*Cross-border exchanges
foster training and trade*



PLUS:
AFVs for Emergencies
LNG at UPS

INSIDE:
**The Hydrogen
Economy**



Dear Readers:

Since the Clean Cities Program was born a decade ago, its growth pattern has been impressive, but hardly a straight line. The program was created with strong congressional backing, primarily as a tool to implement the AFV provisions of the Energy Policy Act of 1992 (EPA Act). Today it is a broad-based government-industry partnership with a diverse agenda, supporting infrastructure development and AFV deployment, now even including hybrids.

In the earliest coalitions, most coordinators were overworked volunteers juggling other jobs as they sought out new stakeholders, organized events, prospected for funds, and diligently advanced the Clean Cities cause. Today's coordinators and their staff are still stretched thin, with even more diverse duties stemming from the program's dramatic growth. Clearly our success is a result of their remarkable market-specific adaptability.

In Minnesota, for example, the Twin Cities coalition has helped create a vast network of E85 fueling stations—a response to the region's bountiful corn crop.

Texas is propane country, with abundant natural gas and oil reserves. All six Clean Cities coalitions in Texas have exploited the state's indigenous natural resources. One result is that Dallas County Schools now use propane in more than 800 buses.

The Land of Enchantment Clean Cities Coalition deserves credit for making the most of New Mexico's natural gas infrastructure. It aided Santa Fe in establishing the nation's first 100 percent CNG-fueled public transit system.

The Central Ohio Clean Fuels Coalition, designated just last year, has already nurtured an AFV marketplace through public advocacy and education. The Ohio Department of Transportation now has nine fueling stations dispensing biodiesel.

Realizing the importance of adaptability within our coalitions, I listened with particular interest to the President's recent State of the Union Address. President Bush announced support for \$1.2 billion in funding over the next five years to develop hydrogen and fuel cell technologies, plus approximately \$500 million specifically for hybrid and vehicle technology research and development.

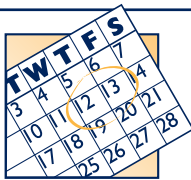
Will it affect Clean Cities? Of course. Many coordinators are already fielding questions about hydrogen. With the rising need for information, we might at least consider the new roles Clean Cities should play in ushering in a hydrogen future. Our well-established coalition network, for example, can help educate the public and foster relationships with government or media. Down the road, opportunities to help deploy hydrogen-fueled vehicles will also emerge.

Some coalitions have a head start on hydrogen. Coachella Valley has worked with SunLine Transit to deploy fuel cell buses and hydrogen-natural gas blends. The Las Vegas coalition partnered with DOE to establish a facility that now generates electricity from hydrogen as well as hydrogen from natural gas. Hydrogen partnerships are being established in the Hampton Roads coalition in Virginia and the Valley of the Sun coalition in Arizona.

No one knows exactly how our nation's energy portfolio will look in the future. But more important than ever will be flexibility of the early adopters. Here's a salute to the coordinators who have recognized their important role all along, and helped to position Clean Cities where it is today—a key player in new energy frontiers.

Shelley Launey, Director

Clean Cities Program
U.S. Department of Energy



Upcoming Conferences and Events

APTA Bus Conference

May 4–8, 2003
Milwaukee, Wisconsin
Contact: Cara Reeve,
202-496-4874
www.apta.com/meetings/bus

9th National Clean Cities Conference

May 18–21, 2003
Palm Springs, California
Contact: Clean Cities Hotline,
800-CCITIES
www.cities.doe.gov

19th Annual International Fuel Ethanol Workshop and Trade Show

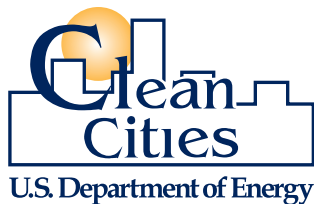
June 16–19, 2003
Sioux Falls, South Dakota
Contact: BBI International,
719-942-4353
www.bbiethanol.com

For more conference and event information, visit www.cities.doe.gov/events CGI.shtml

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Cross-border trade and training exchanges may help clear the air in New Delhi



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On the cover: Scenes from a January visit by several U.S. delegates to India, conducted to provide training in natural gas vehicle technology (see story, page 4). **Above:** Trainers Ed Farrell and Nick Wagner of the National Alternative Fuels Training Consortium, in New Delhi. Photos by Al Ebron.

Are you getting what you need in the *Alternative Fuel News*?

Would you like to subscribe to AFN, or cancel a subscription? Would you like to receive an email message whenever a new issue is posted online, rather than receiving a print copy by mail? AFN is usually available on the Clean Cities Web site before it's mailed. To view or download our latest issue as well as past issues, please visit www.afdc.doe.gov/documents/altfuelnews. You can email us at ccities@nrel.gov, or call 1-800-CCITIES. We welcome comments and suggestions about the content of AFN.

Passage to India

AFV training sessions, cross-border trade missions may help improve air quality and the quality of life in New Delhi.

At least 23 cities in India have populations of 1 million or more, and some are among the world's most polluted urban areas. Most affected is New Delhi, where airborne particulate matter has been gauged at levels of more than 10 times India's legal limit (see www.ccities.doe.gov/pdfs/ghose_02.pdf). Vehicles account for most of the pollution, with more than 3 million cars, trucks, buses, taxis, two-wheelers, and three-wheel rickshaws growing as rapidly as the city's human population.

New Delhi has taken steps to curb air pollution. The city banned vehicles more than 15 years old, and it now enforces Euro II emission standards created for the European Union. India's Supreme Court in 1998 ordered all commercial transport vehicles in New Delhi to be fueled by natural gas. India's strong support of air quality and alternative fuel initiatives has brought progress as well as growing pains to the country.

To support such initiatives, Clean Cities International, in partnership with the National Energy Technology Laboratory, is to receive a United States Agency for International Development (USAID) grant of \$554,000. Terms of the grant require a degree of monetary support from the grant's public and private sector partners. To leverage the anticipated USAID funding, and to help develop export opportunities for U.S. industry, several initiatives to help accelerate the development of AFVs are planned in the coming year, and a few have already taken place.

ON A MISSION

A reverse trade mission last fall brought 11 delegates from India together with U.S. companies and industry associations. Visitors included representatives of the Society of Indian Automobile Manufacturers (SIAM) and several other India trade associations. The trip was co-sponsored by the U.S.-based Gas Technology Institute, the U.S. Asian Environmental Partnership (USAEP), and Clean Cities International.

The trade mission, held October 6–11, 2002, coincided with the Natural Gas Vehicle Coalition's annual World NGV Conference in Washington, D.C. Delegates attended

the conference on several occasions, and had one opportunity to drive NGVs on Washington city streets. Also participating in the week's activities were representatives from Bangladesh, Thailand, and the Philippines—all nations with similar concerns about air quality and natural gas fueling.

Technical training sessions sponsored by Clean Cities International were conducted by the Nevada-based NGV Institute. Engine technology developer Cummins Westport hosted a dinner. The delegation toured a Mack Trucks engine plant and a CNG bus facility operated by the Washington Area Metropolitan Area Transit Agency. The Indian delegates were greeted by Al Ebron of the National Alternative Fuels Training Consortium (see adjacent story).

The week yielded many useful observations and conclusions about vehicles, fuels, and the fueling infrastructure in India. For example:

- Pressure at Indian fueling stations is often no more than 2,400 pounds per square inch (psi), not the 3,600 psi for which vehicles are designed. The result is excessive fill times and long lines at stations.
- Many AFV conversions in India have been done with inappropriate oxidation catalysts and "open loop" systems, causing excessive oxides of nitrogen emissions. Conversions should be done with "closed loop" systems in which the air-fuel mixture is constantly gauged and re-adjusted.
- The percentage of methane in natural gas in the United States is usually 89 percent or more; it varies widely in India. This causes variation in combustion temperatures, air-fuel mix ratios, and emissions.
- India lacks a well-developed underground pipeline distribution system. Fuel is transported by truck from "mother" stations to "daughter" stations. Many types of infrastructure improvement are being considered.
- Natural gas odorants used in the United States to help detect leaks are used in LNG but not CNG in India. Officials are seeking an appropriate substance to use.

Other conclusions, along with a list of all participants in the trade mission, appear in a report available at www.ccities.doe.gov/international/pdfs/cc_triprep_india.pdf.



Ed Farrell of the National Alternative Fuels Training Consortium (center, gesturing) speaks with M. Surendranath, a regional service manager with Ashok Leyland, at a training session in New Delhi.

LPG: PROMISE, BUT PROBLEMS

December 2002 brought a tour of India by U.S. manufacturer representatives experienced with liquefied petroleum gas (called LPG or propane in the U.S. and “autogas” elsewhere). They visited seven cities, and discussed autogas issues with key local stakeholders. The tour was sponsored in part by Clean Cities International.

The nine-day trip was primarily a “fact-finding mission to uncover problems and opportunities for LPG in India,” says Ira Dorfman, a member of the LPG Autogas Delegation. Dorfman is president of consulting firm eMobility International, and supports Clean Cities International.

Some of the facts are a bit alarming, he says. For example, although the Automotive Research Association of India has approved many LPG conversion kits, these kits are intended for use only with transportation-grade storage cylinders. But in practice, vehicle fuel is often stored illegally in low-cost government-subsidized LPG cylinders intended only for home cooking.

Converting gasoline and diesel vehicles to run on LPG has been common throughout India, but many improper conversions—perhaps as many as 1 million—have been done. Dorfman reports that state government officials often possess little technical understanding about conversion kits. And no system is in place to train or certify LPG kit installers, who may be technically proficient but challenged by literacy issues.

Infrastructure presents another challenge. India has imposed LPG station standards that are among the most stringent in the world. Regulations based on these standards have created unintentional obstacles to expanding the country’s LPG infrastructure. For example, the regulations prohibit using the aboveground storage systems that are widely used around the world, and bar the construction of convenience stores, on which the oil companies depend for improved profit margins, adjacent to the fueling stations.

The delegation recommended several near-term actions to address the country’s LPG issues. It suggests creating an Indian LPG Autogas Coalition as a central authority, to ensure a well-coordinated and self-policed LPG program. Also recommended are training and certification of regulation enforcement personnel, and continued sponsorship of trade missions between India and the United States. Delegation members will seek funding and design the training courses in the coming months, according to Dorfman.

Other participants in the LPG tour included K. Balakrishnan of USAEP; Robin Parsons of Clean Fueling Technologies; Suyash Gupta, Shailesh Gupta, and H.S. Gupta of HT Process Controls; William J. Kolb of Liquid Controls; Harshad Chhaya of Liquid Controls India; Gagan Agrawal and Shishir Agrawal of Minda IMPCO; and S.M. Kelkar of OPW India.

CNG: TRAINING THE TRAINERS

India’s interest in AFVs was evident in the turnout at a five-day CNG training course held in New Delhi in January. It was designed as a “train-the trainer” course conducted by the NAFTC, in which students would relate what they learned to service technicians throughout India. Approximately 50 participants included not only technicians and trainers, but also many engineers and representatives of India’s transit industry.

“By the questions they asked, you could tell they were there very much to listen and learn,” said Deputy Clean Cities Director Marcy Rood. The training was co-sponsored by Clean Cities International, SIAM, and New Delhi’s public transit agency.

The curriculum included NGV components and installation, emissions, vehicle electronics, and cylinder inspection. Instruction was provided by two NAFTC trainers: Nick Wagner of Central Community College, Columbus, Nebraska, and Ed Farrell of Wentworth Institute of Technology, Boston.

The training was “a huge success,” says NAFTC executive director Al Ebron. “A lot of the students told us, ‘You’ve given us a way to package and present this information in ways that we hadn’t necessarily thought about.’”

Preceding the technical training course was a four-hour AFV workshop for policy makers, with a similar number of participants. An overview of all AFV technologies covered CNG, LNG, propane, biodiesel, alcohol fuels, electric vehicles, and hybrids. Ajay Maken, New Delhi’s Minister of Transport, Tourism, and Power welcomed the participants and said the city is contemplating increased use of electric vehicles in public transit. Maken said later that New Delhi hopes to sign a memorandum of understanding to become member of Clean Cities International.

PARTNERS WANTED FOR INDIA’S CLEAN AIR/CLEAN FUEL VEHICLE INITIATIVE

Clean Cities welcomes company and industry representatives with an interest in developing LPG and CNG fueling in India. Many have already committed to playing a role in the initiative:

- DOE Clean Cities Program
- National Energy Technology Laboratory
- Society of Indian Automobile Manufacturers
- eMobility International
- National Alternative Fuel Training Consortium
- Science Applications International Corporation
- ANGI International
- Clean Fueling Technologies and Gilbarco/Veeder-Root
- NGV Institute
- IMPCO Technologies, Inc.
- Liquid Controls and Corken Pump
- OPW Fueling Components
- Propane Education and Research Council
- World LP Gas Association

AFVs for EMERGENCY PREPAREDNESS

Alternative fuels and vehicles may help communities cope with dire conditions.

Energy resources are vital to a community's emergency response capabilities. What if an emergency directly affects those resources? In the chaos following a terrorist attack, for example, local fuel shipments may be disrupted. Or international events may create nationwide fuel shortages.

Directed by Energy Secretary Spencer Abraham, the U.S. Department of Energy (DOE) created a task force comprising representatives from the national laboratories to study the vulnerability of the nation's energy infrastructure. "The problem is massive," says task force member John Thornton, an engineer at the National Renewable Energy Laboratory (NREL). "There is so much vulnerable infrastructure—pipes, oil refineries, tankers. The potential for disruption of the oil supply is huge."

Alternative fuels are one key solution suggested by the task force. "Alternative fuels are sometimes viewed as a long-term option," says Thornton, "but they can contribute today." Gasoline shortages could keep most conventional vehicles off the road. But in a truly dire situation, everyday vehicles fueled by natural gas, propane, ethanol, or electricity might serve as ambulances, fire trucks, and police cars.

"Alternative fuel vehicles are the way that cities can respond when things go bad," says Bob Kistner, president of Denver-based Energy Planning Consultants. Kistner's professional background includes work as a disaster recovery manager for the Federal Emergency Management Agency (FEMA) and the U.S. Army Corps of Engineers. He has spoken at Clean Cities regional meetings, showing coordinators how to introduce AFVs into municipal energy emergency response plans.

"Emergency responders may use any available vehicle during an emergency," says Kistner. "This means that any AFV used by any agency is a potential emergency vehicle." Denver, Colorado, for example, is one of several cities that plan to commandeer transit buses for use as ambulances and emergency response vehicles in the event of a major disaster.

DOE requires every state to prepare and maintain an energy emergency response plan. Kistner has participated in drafting such plans for Wyoming, Kansas, Delaware, Arkansas, Colorado, and New Hampshire. But no such requirement applies to municipalities, and many cities and



Virtually any vehicle, such as this natural gas-fueled bus, could be called into service in an emergency. Preparedness planners recommend diversified fueling for state and local vehicle fleets.

counties don't have them, says Kistner. His company has developed a template to simplify the process of preparing for an energy supply disruption.

Shawnee County, Kansas has an emergency plan that was prepared with help from Kistner, with grant funding from the Kansas Corporation Commission Energy Programs and DOE's State Energy Program (SEP). The plan recommends mandatory measures to take effect in the event of a motor fuel shortage. One measure would enact immediate tax exemptions for the purchase of natural gas, propane, and ethanol (assuming those fuels are not also in short supply).

Shortages can take many forms, ranging from local to worldwide. Tension in the Middle East and terrorism at home have spurred interest in alternative fuels for emergency preparedness, according to Ron Raines, fleet manager for the city of Topeka, which is in Shawnee County. "Since September 11, and with the current foreign oil problems, we're looking at a lot of options," he says. At present, 30 of Topeka's approximately 780 vehicles are flexible-fuel vehicles, capable of running on any combination of gasoline and E85 (85 percent ethanol).



In a gasoline shortage—depending on its cause—ethanol may be in short supply too, Raines admits. But as a general principle, safety comes from diversification in local and national energy planning. Topeka may further expand its AFV portfolio, Raines says, by introducing biodiesel in heavy-duty trucks and equipment and battery-electric power in very light vehicles for applications such as parking control.

Another reason for diversification is simply the potential for a large net increase in fuel consumption. “Normally only about a third to half of Topeka’s 160 police vehicles are on the road at one time. In an emergency they’d all be used,” says Raines. “In a real emergency, all emergency vehicles will be on the road, greatly exceeding their normal fuel consumption.”

The time for emergency preparedness is now, says Kansas energy program manager Jim Ploger. “Domestically produced alternative fuels are important for emergencies because international sources of petroleum are so volatile,” he says. “This is especially true for government vehicles and facilities. It takes time to get equipment and infrastructure set up, and they have to be ready when an emergency occurs.”

No specific funds are yet available from FEMA for purchasing AFVs as emergency vehicles. But incorporating alternative fuels into energy emergency plans may be one way to persuade municipalities to choose AFVs during their normal vehicle acquisition process. For this to happen, emergency managers and fleet managers must understand the role of AFVs in emergency preparedness. Clean Cities stakeholders can foster communication among all the players.

Funding is available, in some cases, for counties and cities to write energy emergency response plans. FEMA gives money to the states through technical cooperative agreements, and the states can distribute the money to local governments for emergency preparedness planning and training. Eligibility requirements are strict, however. In Colorado, for example, most counties qualify but only a handful of cities meet the requirements.

Local Factors and Fueling Choices

Natural gas may have one significant advantage for use in a disaster, says consultant Bob Kistner. In a letter to the *Boston Globe* published October 28, 2002, he wrote: “Natural gas is a reliable source of fuel not only because most of the supply is domestic, but also because the pipeline delivery system is underground and protected from weather-related disruptions and terrorist attacks.”

Other fuels have inherent advantages as well. “Ethanol is produced in the United States,” notes Topeka fleet manager Ron Raines. “If there’s a fuel shortage, we think E85 could be a stronger supply than conventional fuels. The same is true for biodiesel,” he says.

Local factors can influence alternative fuel choices. The state of Kansas, for example, has an extensive propane storage and transportation infrastructure, as noted in that state’s energy emergency plan. Its decentralized infrastructure, largely independent of petroleum pipelines, makes propane a logical local choice.

“The role of alternative fuels in emergencies is the same as their role at any time,” says Rick Grice, director of the Colorado Governor’s Office of Energy Management and Conservation. “They create a balance by reducing our reliance on any one fuel.”



Kistner demonstrates an electricity-powered light-duty police vehicle.

To reduce vulnerability to terrorism and natural disasters, the federal government recently created the U.S. Department of Homeland Security. That department and other federal and state agencies could be future sources of AFV funding, says NREL engineer John Thornton. “It seems inevitable that they’ll begin to recognize alternative fuels and AFVs as an important part of homeland security,” he says

Offer Assistance, Seek Support

Clean Cities coalitions can take steps to promote AFVs for emergency preparedness:

- Approach municipal and state fleet managers. (Many are current program stakeholders; others can be located through government directories.) Discuss the basics of AFVs and alternative fuels, and the benefits of a diversified vehicle fleet.
- Assist government agencies in drafting energy emergency plans that incorporate AFVs and alternative fuels. Coordinators may consult first with Bob Kistner, who is a Clean Cities Program partner. Call Energy Planning Consultants, Inc. at 720-596-4980 or visit www.energyplan.net.
- Contact your state FEMA office (visit www.fema.gov) to learn about active emergency planning in your area. Also solicit the participation of other relevant government entities such as state energy offices. Use the directory at www.naseo.org/members/states.htm.



The nation’s vast, largely centralized petroleum infrastructure could fall victim to terrorism or to natural disasters. Fuel diversification may help mitigate the consequences.

The Hydrogen Economy



Jeremy Rifkin is president of the Washington-based Foundation on Economic Trends, and the author of 16 books on the impacts of scientific and technological change. His latest work, "The Hydrogen Economy," warns of potential devastating consequences of worldwide reliance on petroleum energy.

Rifkin says the depletion of oil is unavoidable. He expects world production will peak sometime in the next few decades, with the most alarming projections putting the peak as early as 2010. Defending the world's oil infrastructure has become increasingly expensive, he adds.

Sustainability in modern times can come only from renewable energy sources, particularly wind, solar, biomass, geothermal, and hydroelectric, he says. To effectively deliver their power to the end uses (including transportation) will require a key means of energy storage—hydrogen. Renewable sources would first produce electricity, as many already do economically. The electricity would be used to electrolyze water, yielding hydrogen fuel. Stored in pressurized tanks, the hydrogen would then feed proton-exchange membrane fuel cells, producing electric power without pollution or greenhouse gas emissions.

Fuel cell power has an enormous range of potential applications, both stationary and in automobiles. Rifkin envisions a "peer-to-peer" network of power producers analogous to the World Wide Web, in which individual users can create their own "content." Cars may become rolling power plants, ready to plug into the grid and generate profits for their owners. Rifkin believes decentralized, distributed generation of power can redistribute social power as well, lifting Third World countries from poverty, narrowing the gap between haves and have-nots, and easing international tensions.

In a January interview, Rifkin addressed several questions about the move to a hydrogen economy.

"The Hydrogen Economy," by Jeremy Rifkin;
September 2002, Tarcher/Putnam; 336 pages.
Visit www.foet.org/Books.htm.

Hydrogen power requires generating electricity twice: Once to electrolyze water, and again to produce electricity in fuel cells. How efficient can this be?

That's the first critical question, I agree. You can't have the kind of renewable energy society that so many of us have advocated in the last 30 years without a storage carrier. That's something that's been woefully absent from the discussion. You can create electricity with renewables, but it can't be stored; it flows immediately. If you use it to electrolyze water and grab the hydrogen, then you have stored energy like a fossil fuel. Hydrogen is the centerpiece of a society based on renewable energy.

It is more expensive at present, but that's already changing. Moore's law has taken hold, in this technology revolution as it did in the personal computer and software revolutions and later in the biotech revolution. We're doubling the knowledge and halving the costs every 18 months. As economies of scale kick in, the cost of renewable technologies will continue to plummet. Fuel cells are two-and-a-half times more efficient than the internal combustion engine, and their waste heat can be exploited in co-generation applications.

In "The Hydrogen Economy," you write about the implications of increasing petroleum costs and the decreasing cost of renewable energy. Can you elaborate?

We're going to see the crossing of two bell curves. One represents the falling cost of renewable energy, and the other represents the rising cost of oil. The direct cost of oil and gas are already going up on world markets. We're moving toward global peak. It may come at the end of this decade or as late as 2035 or 2037, but in any case we're talking a very short time before we reach global peak.

Peak is when half the reserves of cheap crude oil are used up. That's the end of the age—the top of the bell curve. Once that happens, except for short dips, prices never go down again. They go up dramatically as you descend the bell curve. And the indirect costs of using petroleum are far more significant—the effects of global warming. I work with the CEOs of the major reinsurance companies. When we sit down privately, they are completely at a loss as to how to calculate the economic costs that are going to mount each decade from global warming. Those costs are across the board—drought, depletion of agricultural yields, fires, flooding, severe weather patterns, destruction of property and real estate...it goes on and on.

Has the development of other alternative fuels been useful on the pathway to develop hydrogen components or infrastructure?

The development of natural gas has been very useful. At present, most commercial hydrogen is extracted from natural gas. Energy companies realize they have to diversify

their portfolios, and they're moving increasingly toward natural gas as oil becomes more unpredictable and expensive and difficult to manage. Natural gas is better than oil in that it emits less CO₂. The problem is, peak production of natural gas will occur maybe 10 and 15 years after the peak of oil. But natural gas is an essential as part of the transition to a totally integrated renewable energy future based on hydrogen.

Renewable fuels will be an essential part of our energy picture. For all the folks who have labored in renewables for so long, I know how frustrating it can be. Sometimes we can envision the future but we can't imagine how we're ever going to get there. What I'm saying to them is now the threshold is here. From a geopolitical, economic, and social point of view, we've arrived at the door. Right at the time when a lot of people in renewables are getting tired, we are at the door.

Can you compare U.S. progress with what's happening in Europe?

Last year I provided a detailed white paper to the European Commission, which is the governing body of the European Union. It outlined a step-by-step strategy to move out of fossil fuels and into a fully integrated renewable economy based on hydrogen, with natural gas as a transition stage. That paper led to the announcement in October of a \$2 billion government-industry partnership in the pursuit of a hydrogen economy, with substantial involvement by the research and scientific communities. President Romano Prodi said that the EU scientific effort would be as important to Europe as the space program was to the United States in the 1960s and 1970s.

European energy companies like BP and Royal Dutch Shell get what I'm saying. They're eight or nine years into this. The transition to renewables and hydrogen is being pushed by the current CEOs, on their watch. They're buying up all the renewable technology, and licensing and patenting it. On the one hand I applaud the Europeans, but on the other hand what happens in the United States if they've locked up all the technology?

What happens?

The great economic revolutions have been around energy. When we went to steam power and coal and laid down rails, that was the first economic revolution. The multiplier effect lasted for the entire 19th century. When we went to the internal combustion engine and oil and electrification, the result was a second economic revolution. What made England powerful in the 19th century was coal. What made America powerful in the 20th century was oil. Now the world is poised for the end of the oil era. The countries and regions that emerge as powers in the 21st century will be the ones making what I call a parallel track approach into renewables and hydrogen.

What other international factors should affect our thinking about hydrogen?

We should be concerned about becoming totally dependent on the Middle East for oil. The fastest population surge is happening across the Islamic Belt. And where you find Islam you find oil. Young people there are uneducated, poor, disenfranchised, and marginalized. They're abused by their own governments and they hate the West. That population will peak right around 2010 or 2015, at the time when most of the remaining oil reserves will be in the Middle East. This is a prescription for tremendous geopolitical conflict.

Another mounting international crisis is Third World debt. Developing countries pay 83 cents of every dollar they generate just to service loans they have incurred to buy oil. Their poverty fuels resentment of the West. But in a hydrogen-based economy, as renewables get cheaper, people will be able to produce locally and sell globally. We can reduce the tensions between the haves and the have-nots, the connected and the unconnected, when we have the whole world participating. That's re-globalization.

You seem to be part social activist, advising common people to take control of the coming energy infrastructure. Why is it important for power to be controlled by the people? Why not let the marketplace run its course?

If you had let the marketplace run its course in the early 20th century, workers wouldn't have been able to organize effectively against large corporate interests. The market would have said let's just pay what the market will bear. Workers realized they had to join collectively so that their individual power plants—their minds and bodies—could work together collectively to negotiate a fair social contract with management. That's what created the great boom and the prosperity after World War II. We finally had enough labor power around the world to have a just and sustainable social contract with management.

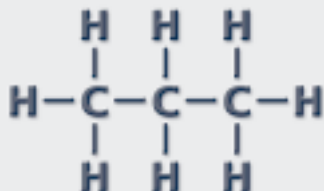
We will certainly see commercial interests trying to exercise some authority in the hydrogen economy. Let the Shells and BPs develop the renewable technologies. Let the Ballards and General Electrics develop the fuel cells. Let the auto companies develop hydrogen cars, and let Hewlett Packard build the hardware and Microsoft develop the software for the decentralized power grid. But let the end users control the energy they generate, so we can have a worldwide partnership based on reciprocity. Developing nations would be among the greatest beneficiaries, and it would be part of a win-win scenario.

Today's alternative fuels may create pathways to hydrogen.
(See page 10)

Today's Alternative Fuels Create "Pathways" to Hydrogen

An ambitious initiative announced by President Bush in January solidifies America's resolve to make hydrogen a core holding in its energy portfolio. The Bush administration supports \$1.2 billion in funding over the next five years to develop hydrogen and fuel cell technologies, plus approximately \$500 million specifically for hybrid and vehicle technology research and development. More informa-

tion about the hydrogen initiative, and hydrogen in general, is available at www.eere.energy.gov/hydrogenfuel and at in the Alternative Fuels Data Center at www.afdc.doe.gov. Other alternative fuels may help pave the way to a hydrogen-based economy. Below are some of the unique characteristics and advantages of each:



Liquefied Petroleum Gas—LPG (C₃H₈) is also rich in hydrogen and low in carbon. Like natural

gas, it brings the advantages of an established distribution infrastructure, but relying on above-ground tanks and tanker trucks as well as pipelines. As a gaseous fuel, LPG (also called propane) will continue to yield valuable lessons about storage, operator training, and public acceptance. Already existing, at least in prototype, are fuel cells powered by LPG.

Ethanol and Biodiesel—Hydrogen can be reformed from biofuels such as ethanol (C₂H₅OH) and biodiesel (one typical blend is C₁₉H₃₆O₂). Domestic, renewable crops such as corn and soybeans are the most prevalent feedstocks. Future sources of ethanol may include wild grasses and urban waste. The availability of biofuels is growing

rapidly, but it is still tied to the proximity of agriculture. As liquid fuels, ethanol and biodiesel can use much of the existing petroleum infrastructure.

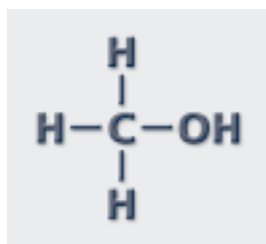


Sunline/PIX 10720

Natural Gas—Most hydrogen currently comes from natural gas, extracted through a steam reformation process. The low-carbon molecu-

lar structure of its main component, methane (CH₄) accounts for the prominence of natural gas as an alternative fuel as well as a hydrogen source. It is distributed through a vast underground pipeline infrastructure, conducive to a future decentralized distribution system in which hydrogen could be reformed on-site at many locations.

Methanol—Still an EPA-approved alternative fuel, hydrogen-rich methanol (CH₃OH) has become nearly non-existent in today's alternative fuel marketplace. But in a hydrogen economy, it could make a substantial comeback. Methanol is a liquid fuel made mostly from natural gas. Direct-



methanol fuel cells are often discussed as an alternative to hydrogen fuel cells, simpler in design because they don't rely on pressurized gaseous fuel.



Electricity—Zero-emission vehicles powered by hydrogen will owe a great debt to ZEVs that came earlier. Energy storage technology developed for electric cars has already migrated into hybrid-electric vehicles. A likely next step will be hybrid vehicles that employ batteries and ultracapacitors, but with fuel cell propulsion replacing the internal combustion engines in today's hybrids. Ultimately fuel cells would be the sole onboard source of electricity. Hydrogen-powered vehicles could also become mobile "power plants," feeding electric power into the grid when they're parked.



H₂



Federal News

Attention!

Leadership from the upper ranks commands AFV action in the Marines.

The U.S. Marine Corps is very committed to alternative fuel vehicles (AFVs) and the fuels that power them. So much so that it exceeded its EAct Federal Fleet requirements by more than 100 percent in FY 2002, and has already met the goals of Executive Order (E.O.) 13149.

EAct says 75 percent of a Federal Fleet's annual light-duty vehicle (LDV) acquisitions must be AFVs. Additionally, under E.O. 13149, certain federal fleets must also lower their annual petroleum consumption by 20 percent by 2005, compared to their 1999 consumption levels.

The Marine Corps acquired 1,897 LDVs in 2002. But many exemptions apply, for acquiring vehicles such as ambulances, for example, and only 355 vehicles were required to be AFVs. The Marines purchased a total of 512 AFVs during the year, and earned an additional 221 credits for acquiring dedicated light-, medium-, and heavy-duty AFVs, and 129 credits for its use of biodiesel. This left the Marine Corps with a total of 862 AFV credits—more than twice its EAct requirement.

The Marine Corps also exceeded the requirements of E.O. 13149, three years ahead of schedule. As of 2002, the Marines tallied a total petroleum (gasoline and diesel) reduction of more than 2.58 million gasoline-gallon-equivalents (gge), or 24.5 percent of its 1999 fuel consumption of approximately 10.53 million gge.

"Our leadership really bought into this program. I think that's the real key to our success," says Tim Campbell, head of the Garrison Mobile Equipment Section. "If you don't have buy-in from your leadership, you won't have a successful program." Tom Smallwood, senior contract advisor at Marine Corps headquarters, agrees.

It's Smallwood's job to make sure the Marine Corps meets its annual EAct and E.O. 13149 requirements. He has approximately 8,000 vehicles to keep track of and does so by keeping in close contact with fleet administrators and validating their reporting data.

Eight thousand vehicles may sound like a lot, Smallwood says, but that's about a quarter of the size of the U.S. Army's vehicle fleet. "To some degree, because the Marine Corps is smaller, we have direct access to our fleet managers and can provide personal guidance, tailored to their needs."

According to Smallwood, fleet managers at Marine Corps bases and stations are genuinely concerned about the environment and energy security and are therefore willing

to try new things, including alternative fuels and vehicles. For example, the Marines have been successfully using neighborhood electric vehicles (NEVs) for light hauling and administrative purposes.



AFVs in the the Marine Corps (from top) include electricity-powered rifle range trucks, biodiesel buses, and electric light-duty vehicles such the Ford Ranger pickup.

In 2002, five California installations received 115 various NEV models and the Marines continue to add CNG vehicles in areas with established natural gas infrastructure.

Plans include acquiring medium- and heavy-duty non-tactical vehicles that run on alternative fuels. The Marines also plan to expand the E85 infrastructure and increase the number of vehicles that use it. For example, in Camp Lejeune, North Carolina, the Marine Corps is building an E85 site using a \$25,000 Department of Defense grant.

For FY 2003, the Marine Corps plans to acquire approximately 411 light-duty AFVs—16 percent more than the 355 vehicles needed to satisfy federal fleet mandates. "Making the numbers, or compliance with the mandate, is only half of it," says Smallwood. "It's just the right thing to do."

U.S. Marine Corps



From the States

UPS Deploys LNG Tractors

“Rolling laboratories” to research emissions

United Parcel Service (UPS) has introduced what it calls the package delivery industry’s first alternative fuel Class 8 tractors. In December 2002, UPS tractor-trailers fueled by liquefied natural gas (LNG) began traveling daily between Ontario, California and Las Vegas, Nevada. The 470-mile round-trip route is part of the Interstate Clean Transportation Corridor (see related story, below).

The 10 LNG trucks are part of the company’s “laboratory on wheels” strategy—a framework for testing new technologies to reduce emissions. UPS is working with various engine manufacturers to test emission-reducing technologies. As a minimum standard to qualify for UPS testing, all technologies must first be recognized by the Society of Automotive Engineers.

“With the introduction of LNG tractors, we now operate alternative fuel vehicles in every part of our fleet,” said Ron Kirby, corporate automotive engineering manager for UPS. The company also operates the nation’s largest private fleet of CNG vehicles. UPS is testing one hybrid-electric delivery truck in Huntsville, Alabama, and it uses 13 all-electric Chrysler EPIC delivery vans in Los Angeles. More than 800 propane-powered UPS trucks are in use, mostly in Canada and some in Mexico City. The company is reviewing fuel cell technology project plans.

Rolling on the ICTC

Created in 1996 with support from Clean Cities, the Interstate Clean Transportation Corridor (ICTC) is the product of many successful public-private partnerships to promote alternative fuels and AFVs in interstate transport. Following state and interstate highways, the ICTC currently connects San Diego with Sacramento. Another leg runs northeast from Ontario, California to Las Vegas. Plans are to ultimately complete a triangular route with its points at Los Angeles, Sacramento, and Salt Lake City.

The ICTC is directed by the southern California office of Gladstein & Associates. To date, the firm has helped to secure \$19.2 million to deploy vehicles and fueling stations on the corridor. More than 500 natural gas and LPG vehicles, mostly heavy trucks, have been funded by these efforts, according to Gladstein. More than 20 natural gas fueling stations have either been established or are under development between Barstow, California and Winnemucca, Nevada. Four new LNG stations are expected in the coming year.

LNG tractors cost \$35,000–\$40,000 more than comparable diesel-fueled models, according to Kirby. But early data suggest that LNG use has been successful in addressing all major concerns including the cost of maintenance and overall operation, as well as power and emissions.

The LNG engines were designed with Dual-Fuel™ technology, developed by Clean Air Partners. The system allows the engine to operate on a small amount of diesel fuel while using LNG as the primary fuel source. The system eliminates the need for spark plugs. Maintenance costs are further reduced because the oil is changed less often.

LNG yields slightly more than half the fuel economy of diesel, and costs slightly less than half per gallon, the company reports. As a result, fuel costs are reduced by a small percentage. LNG is sufficiently dense in energy to fuel large trucks traveling long distances between refueling. Each of the 10 LNG tractors operated by UPS between Ontario and Las Vegas hauls two 28-foot trailers. Fitted with auxiliary tanks that boost fuel capacity by about 50 percent, they can go 600 miles before refueling.

The company’s Ontario, California fueling station also supplies LNG and CNG for municipal fleets, transit agencies, waste haulers, and various company vehicles. The stations are operated by FleetStar, a division of Applied LNG Technologies USA.

Biodiesel is Best in Breckenridge

The town council of Breckenridge, Colorado last year asked Dan Bell, assistant director of public works, to investigate alternative fuels for use in its own vehicles. The request came because the council members and the citizens have a strong sense of local and global environmental responsibility, and they want to improve the quality of life in their community.



Breckenridge/PIX 12411

Breckenridge operates a front-end loader and several other municipal vehicles on B20 biodiesel.

Bell researched available fuels and chose biodiesel (B20) because he felt it would be the easiest to implement and would have the greatest chance of success. The fuel requires no change in system, infrastructure, or vehicles. It was just a matter of calling the fuel supplier to place the order, then filling the tanks. According to Bell, “We want to be cutting edge, but we also have the obligation to do the right thing by our citizens, with their money. So we based our decisions on what is likely to succeed.”

Breckenridge currently runs six vehicles—two buses, a front end loader, a dump truck, a loader (sidewalk snowplow) and one street snowplow—on B20. Breckenridge is a ski town, and at least two local resorts (see adjacent story) now use B20 in buses and snow-grooming equipment. They have the same motivation to reduce emissions as Breckenridge.

Bell said that so far, he and the town are pleased with the biodiesel program, which began in June 2002. “So far, we have no issues whatsoever. The direction that I’ve taken with this from the very beginning is that we’ll continue with the program until we see something that would cause us to turn back. That has yet to happen.”

Of course the main challenge with B20, as with regular diesel, is cold weather. Winter nighttime temperatures in Colorado mountain towns often dip to -20°F —well below normal gelling temperature for B20. Bell worked with his fuel supplier to formulate a fuel that can resist gelling to -30°F . But its limits are rarely tested; normally the vehicles are parked indoors overnight.

Another slight drawback is cost. B20 costs $\$0.014$ – $\$0.017$ more per gallon than diesel. With its limited range of applications, the added cost of using biodiesel in Breckenridge is less than $\$10,000$ —a fraction of total fuel costs for a fleet using approximately 145,000 gallons of gasoline and diesel per year. As a proportion of the town’s $\$5.7$ million public work budget, Bell notes, the incremental cost of biodiesel is much smaller.

“We have a very broad view of the benefits,” he adds. “Air quality improvement is just a part of it. We’re finding our influence reaches well beyond our town limits. If we can influence larger fleets including other mountain towns, for example, that may have a significant impact in terms of air quality and reducing our dependence on foreign oil. As long as the economy in this area provides us with revenues to sustain a project like this, we will continue do at least a little more than we have to.”

Colorado mountain towns resort to B20

Officials at the Breckenridge Ski Resort are testing B20 biodiesel in two buses. “We really want to use it; we feel it’s the right thing to do,” said Rick Sramek, director of mountain operations. Ultimately, he’d like to use biodiesel in the resort’s 18 snowcats and 19 buses.



Breckenridge/PIX 12412

B20-powered buses serve skiers at the Arapahoe Basin resort in Summit County, Colorado.

“We’re looking for equipment that runs well and that reduces particulate matter. And we owe it to ourselves and everyone else to try it,” Sramek said.

The nearby Arapahoe Basin resort converted all its diesel vehicles, including five snowcats and two pieces of heavy machinery, to biodiesel and noticed no operational differences.

Summit County (where Breckenridge is located) is considering biodiesel for its fleet of 88 vehicles, which includes 28 off-road vehicles such as front-end loaders and bulldozers; 57 on-road vehicles such as shuttle buses, ambulances, and snowplows; and three stationary generators. The county will make its decision after the results of B20 use by other fleets in the area.

BIGMan Makes Little Cars with a Big Difference



The Central Oklahoma Clean Cities Program welcomed Barton Investment Group Manufacturing LLC as its newest stakeholder in 2002. Oklahoma-based "BIGMan" produces a low-speed electric vehicle for use in parks, parking lots, resorts, zoos, police departments, military installations, industrial complexes, college campuses, and retirement communities.

The vehicle is designed solely for on-road use, so it is heavier, sturdier, and has a much more substantial battery pack than other neighborhood electric vehicles, the company says. Central Oklahoma Clean Cities stakeholders have participated in demonstration drives around Oklahoma City's Bricktown business district. They were impressed with its solid feel, responsiveness, maneuverability, and practicality, according to coordinator Yvonne Anderson.

The coalition was instrumental in passing 2001 legislation that allows low-speed electric vehicles to be driven on state and city streets and roadways with speed limits of 35 mph or less. That legislation may open the door to allowing low-speed electric vehicles to qualify for state income tax credits as alternative fuel vehicles.

Tinker Air Force Base Wins Environmental Honor

Central Oklahoma Clean Cities stakeholder Tinker Air Force Base (TAFB) has been named the recipient of the General Thomas D. White Environmental Quality Award for 2002. The award is the highest environmental honor bestowed by the U.S. Air Force. Representatives of the facility will accept the award on May 7, 2003 in Washington D.C. This year marks the third time TAFB has received the award.

Located near Oklahoma City, TAFB boasts of the largest natural gas vehicle fleet in the Air Force, and operates many electric- and propane-powered vehicles. It is transitioning its entire fleet of diesel vehicles to biodiesel fuel.

"Winning the award is not easy," said base environmental management director Vicki Preacher. "I think we won because we have people who are passionate about the installation's environmental programs. They take these

programs seriously and go above and beyond what's required." In addition to using alternative fuels, the base has staged environmental technology demonstrations and implemented toxic release inventory reductions.

North Florida County Eyes Clean Cities

Clean Cities representatives met recently with officials of north central Florida's Alachua County, which includes the city of Gainesville, to discuss joining the program. County officials cited the desire to create a new AFV market, prove its alternative fueling infrastructure, and reduce U.S. dependence on foreign oil sources.

"Every night on the news we see issues about oil," county manager Randy Reid told the Gainesville Sun. "Reducing the nation's dependence is not just an environmental issue, but an issue of how we are going to conduct business in the future." Many of the Alachua County's larger vehicles such as fire and garbage trucks are already fueled with biodiesel, according to county fleet manager Wendell Chastain.

If designated, the area would make up the program's third Florida coalition, joining the Gold Coast coalition based in Hollywood and the Space Coast coalition based in Cocoa.



Water Taxi, Inc./PIX 12410

They yield no AFV credits for their owners, but "alternative fuel vessels" are doing their part to cut traffic congestion and emissions in Fort Lauderdale, Florida. The hybrid-electric Water Bus runs on electricity and B20 biodiesel, consuming just half the fuel per day of similar diesel-powered boats. It is one of 17 vessels, including eight hybrids, operated by Water Taxi, Inc. The fleet was financed in part with grants from Broward County Transit and the Federal Highway Administration. Approximately 400,000 passengers per year park their cars and commute around Fort Lauderdale via Water Taxi. More information is at www.watertaxi.com.



On the Web

EPAct Rulemaking Addresses Private & Local Government Fleets

After years of analysis and discussions with potentially affected stakeholders, DOE has issued a notice for proposed rulemaking (NOPR) that would leave the acquisition of alternative fuel vehicles (AFVs) by private and local government fleets optional under the Energy Policy Act of 1992 (EPAct).

The adoption of the rulemaking hinges on whether an AFV acquisition requirement is necessary to achieve the petroleum replacement fuel goals set forth under EPAct's Private & Local Government (P&LG) Program. In the NOPR, which appeared in the *Federal Register* in March, DOE asserts that the mandatory acquisition of AFVs by private and local government fleets would result in only a negligible increase in replacement fuel use—not enough to contribute to meeting EPAct's replacement fuel goals. The NOPR also indicates that petroleum replacement would be negligible because DOE does not have authority under EPAct to require these fleets to use alternative fuels in the AFVs they require.

DOE will hold a public hearing in Washington, D.C., to receive input on the rulemaking. As of press time, a date has yet to be set. For more information on the rulemaking, including a downloadable PDF of the NOPR, visit the P&LG Program Web site at www.ott.doe.gov/epact/private_fleets.shtml.

Publication Simplifies Hybrid Tax Incentives

Hybrid electric vehicle (HEV) owners are eligible for significant tax incentives from the federal government and some states. The Internal Revenue Service (IRS) and several state revenue departments have recently made the incentives easier to claim. A new fact sheet from DOE's National Renewable Energy Laboratory (NREL) shows how.

"Hybrid Electric Vehicles: Tax Incentives" was produced to help buyers save money and encourage HEV sales by auto dealers. One side of the fact sheet provides information on the federal tax deduction. Its reverse side outlines a tax credit available to Colorado residents from that state's department of revenue.

The publication was produced by NREL under a collaborative initiative with the Colorado Front Range community because of numerous inquiries about how to take advantage of HEV tax incentives. The IRS and the Colorado Department of Revenue provided input.

The same incentives apply to AFVs that run on recognized alternative fuels including natural gas, propane, ethanol, and electricity. Provided are the exact dollar amounts that can be claimed, how to file, requirements for claiming, and more.

It is available online at www.ott.doe.gov/hev/pdfs/032873mFS_TAX_FS2.pdf. The publication can be downloaded and distributed in unlimited quantities by interested parties such as car dealers. For information on tax incentives offered by other states, visit the incentives page of the Clean Cities Vehicle Buyer's Guide for Consumers at www.ccities.doe.gov/vbg/progs/laws.cgi.

Clean Cities Fact Sheet Outlines Alternative Fuel Funding Sources

Sources of funding for the purchase of AFVs and for related alternative fuel activities are described in a soon-to-be-published Clean Cities fact sheet. The publication outlines eligibility requirements and application procedures for several federal programs including:

- State Energy Program grants from DOE
- Congestion Mitigation and Air Quality grants from the Federal Highway Administration and Federal Transit Administration

Also listed are contacts to help locate funding sources for specific alternative fuels, including the Natural Gas Vehicle Coalition, National Ethanol Vehicle Coalition, National Biodiesel Board, Propane Education & Research Council, Electric Drive Transportation Association, and Methanol Institute. The publication lists other funding alternatives such as individual automakers, and online resources such as the U.S. EPA Database of Transportation-Related Grants.

"Funding Alternative Fuel Activities" will be in print by mid-May and distributed at the 2003 Clean Cities Conference. It will also be available from the Clean Cities Hotline at 800-CCITIES, and will be posted in the Alternative Fuel Data Center at www.afdc.doe.gov.

Register Online for the National Clean Cities Conference

“The Future of Transportation” will be the focus of Monday’s opening alternative fuels session at the 9th National Clean Cities Conference, set for May 18–21 in Palm Springs, California. The talk will follow welcoming remarks by conference hosts and the mayors of Palm Springs and Riverside. Monday afternoon will feature a stimulating general session on hydrogen energy, followed by concurrent talks on alternative fuels and energy security, marketing ethanol, and AFV market development.

Tuesday is Fleet Day, with sessions on niche markets, California incentives and mandates, understanding EPA Act, and emissions reduction through AFVs. Maintenance and safety courses will cover heavy-duty emissions standards, infrastructure challenges, and purchasing vehicles through GSA. On Wednesday, Clean Cities will present its annual Coalition and National Partner awards. The last general session will be titled “Mayors Who Make the AFV Difference.”

Open all day on Monday and Tuesday will be the Clean Cities Exposition, with an array of exhibitors including AFV manufacturers, equipment makers, and industry associations. A continental breakfast and lunch will be served both days.

This year’s Clean Cities Conference will also include:

- A new edition of the PBS program *MotorWeek*, introduced by executive producer John Davis. The show will focus on E85-capable flexible fuel vehicles.



- Tours of SunLine Transit and its Clean Fuels Mall, offering natural gas and hydrogen to the public 24 hours a day; and Waste Management of the Desert, with California’s largest fleet of heavy-duty CNG trucks.
- Ride-and-drive opportunities with all types of AFVs available. On hand will be a propane-powered pickup truck from President Bush’s ranch in Crawford, Texas, driven by the ranch foreman.
- An opening reception hosted by General Motors at Palapas of Araby Cove, a 14-acre village shadowed by

the Santa Rosa Mountains, where distinguished artists display their works.

- A grand finale event sponsored by Ford Motor Company at ATLAS, a chic restaurant and dance club.

Discounted rates are offered by the two official conference hotels—the Wyndham Palm Springs and the Hilton Palm Springs Resort. Both are located just two miles from the Palm Springs International Airport. American Airlines and EV Rental Cars also offer special rates for conference participants.

Early registration is encouraged, with reduced rates offered until April 11, 2003, and substantial savings available by registering online. For more information or to register, visit www.cities.doe.gov and click on “Clean Cities Conference,” or call 800-CCITIES.